ERCB

Canadian Natural Resources Limited
Well Blowout
09-12-75-12W6M
February 24, 2010

ERCB Investigation Report

February 11, 2011

Energy Resources Conservation Board

ENERGY RESOURCES CONSERVATION BOARD
Investigation Report: Canadian Natural Resources Limited, Well Blowout, February 24, 2010

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1 Incident Overview

On February 24, 2010, Canadian Natural Resources Limited (Canadian Natural) experienced a loss of well control (blowout) and fire while drilling a well located at Legal Subdivision (LSD) 9, Section 12, Township 75, Range 12, West of the 6th Meridian (9-12). The 9-12 well is licensed for 43,100 parts per million (ppm) (4.31 per cent) hydrogen sulphide (H_2S) gas content and is a confidential exploratory well. The 9-12 well is located about 2.2 kilometres (km) northwest of the Village of Hythe. The emergency planning zone (EPZ) for the well was 380 metres (m). There were no residences within the EPZ, the closest residence was 7.4 km from the 9-12 well.

At about 2:00 a.m., the mud motor[1] of the drilling rig stalled while drilling into the target formation. The mud motor stalled a second time at 2:09 a.m. The rig crew noticed a kick[2] at 2:10 a.m. and shut in the well at 2:12 a.m.

Between 2:12 a.m. and 3:05 a.m., the rig crew attempted to control the kick using conventional well control methods. During this time, drilling mud was coming out of the mud tanks and spreading across the lease and the H_2S alarms sounded.

At 3:05 a.m., in an effort to not exceed surface equipment pressure limits, the rig crew directed all flow from the wellbore through the choke manifold to the flare stack.

At 3:31 a.m., there was gas present around the well centre in the rig cellar. At this time, all nonessential personnel evacuated to the lease road, while essential personnel remained on site to continue attempts to control the well.

At 4:00 a.m., Canadian Natural notified the Energy Resources Conservation Board (ERCB) Grande Prairie Field Centre (GPFC) that a blowout was occurring at the 9-12 well. The GPFC classified this as a level 2 emergency[3] using the ERCB's Assessment Matrix for Classifying Incidents and initiated ERCB response procedures. At this time, Canadian Natural also activated its corporate emergency response plan (ERP). As there were no residences or other surface developments located in the 380 m EPZ, a site-specific ERP and evacuations were not required.

By 4:12 a.m., the presence of gas around the well centre had increased, as had the well control manifold pressures. All remaining personnel evacuated from the well site.

At 5:41 a.m., the ERCB's Emergency Response Group (ERG) sent out an initial notification of the blowout to internal staff and external government support agencies. ERCB Field Surveillance and Operations Branch (FSOB) response staff dispatched to the site.

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[1] A hydraulic motor, driven by the mud pump, that drives the drill bit.

[2] A kick is any unintended entry of water, gas, oil, or other formation fluid into a wellbore that is under control and can be circulated out.

[3] A level-2 emergency is defined as an incident where there is no immediate danger outside the licensee's property or the right-of-way, but there is the potential for the emergency to extend beyond the licensee's property. Outside agencies must be notified. Imminent control of the hazard is probable but there is a moderate threat to the public and/or the environment. There may be local and regional media interest in the event.

At 6:44 a.m., the blowout self-ignited and the resulting fire encompassed the lease, causing the destruction of most of the surface equipment on site.

At first light, the GPFC began receiving calls regarding the smoke plume from the well, which could be seen clearly from Hythe, the City of Grande Prairie, and rural residences located up to 40 km from the 9-12 well.

By 1:00 p.m. on February 24

- Canadian Natural established an on-site command post (OSCP) adjacent to the 9-12 well site and an off-site command centre (OSCC) and Calgary office command centre (COCC) at its Calgary corporate office.
- Well control specialists contracted by Canadian Natural had arrived on site.
- Local residents and a film crew who were in the area arrived at the 9-12 well. As a result, Canadian Natural contacted the local RCMP to assist with securing the site.
- One mobile air monitoring unit (AMU) belonging to the ERCB and two contracted by Canadian Natural arrived on site between 9:00 a.m. and 10:00 a.m. to commence monitoring.
- A regional emergency operations centre (REOC) was established by the GPFC in its office.
- The ERCB, in consultation with other government responders, activated the government emergency operations centre (GEOC) in Edmonton.
- Alberta Sustainable Resources Development (SRD) took aerial photos of the blowout. These were used to assess potential forest fire hazards and to determine the extent of damage on the site.
- The ERCB issued a Notice to Airmen to restrict air travel in the area.
- The ERCB, SRD, Alberta Environment (AENV), Occupational Health and Safety, the RCMP, and the well control specialists all had representatives at the OSCP.
- The REOC, the GEOC, and the British Columbia Oil and Gas Commission held a teleconference to provide a government-wide update.

By the end of the day on February 24

- Canadian Natural moved its OSCP to a location about 3 km from the lease site.
- Canadian Natural established a REOC at its Grand Prairie field office, and the REOC at the GPFC was moved to this field office.
- An area was cleared to house a water tank farm, and the well control crew began spraying the lease down with water to cool and partially extinguish the fires.
- Canadian Natural was able to begin removing equipment from the 9-12 site.

- Because of the potentially hazardous conditions in and surrounding the 9-12 site, the ERCB issued a fire hazard order (FHG 04-1) to close the area and prevent unauthorized personnel from entering.

- Both Canadian Natural and the ERCB issued press releases to advise the media that the blowout had occurred.

From February 25 to March 7

- AENV, the ERCB, and Canadian Natural developed a comprehensive air monitoring plan.

- Canadian Natural installed seven stationary AMUs in areas where it expected impacts from the blowout to be the greatest. A total of eight mobile AMUs, including the AENV Mobile Air Monitoring Laboratory (MAML), monitored at a network of locations surrounding the 9-12 site and responded to shifting wind conditions and resident concerns as required.

- Canadian Natural drilled a water well to provide the water needed for the site. Wastewater was contained in a lined sump on lease and was later disposed of in accordance with ERCB requirements.

- Canadian Natural made plans to drill a relief well in the event that well control operations planned for the 9-12 well were unsuccessful.

- Canadian Natural cleared a large staging area near the 9-12 site. It stored all damaged equipment removed from site in the staging area before it was either disposed of or sent for testing and analysis.

- Canadian Natural excavated the area around the well centre to expose the surface casing and wellhead.

- Canadian Natural installed a casing extension and a new casing bowl.

- Canadian Natural commenced drilling of the relief well, at LSD 16-12-78-12W6M, on March 5.

- At various times, the ERCB called the local RCMP to investigate the presence of unauthorized persons seen inside of the fire hazard order boundary and to enforce the order.

- H_2S readings of the gas stream taken at the wellhead on different days ranged from 500 to 1200 ppm.

- Alberta Health Services (AHS) and Canadian Natural were in regular contact with a resident who lived about 8 km from the 9-12 site regarding potential health concerns.

- Canadian Natural, the ERCB, and the well control specialists met twice daily at the OSCP for planning meetings.

- Canadian Natural, the ERCB, and AENV met every morning at the REOC to provide updates on all aspects of the response to the directly involved agencies. On March 1, representatives from AHS also began attending the REOC meetings.

- GEOC teleconferences were held daily until March 1. Information updates were disseminated by the GEOC to all government agencies, as well as local politicians and those agencies not directly involved in the response. On March 1, the GEOC was stood down until the next phase of well control operations commenced.

On March 8

- Canadian Natural commenced the well control operation by extinguishing the flame and installing a new blowout preventer (BOP) on the well. Prior to beginning operations, the following occurred:
  - Canadian Natural updated local residents and local authorities (the County of Grande Prairie and Saddle Hills County) of the potential for odours during the operation.
  - The GPFC updated the Horse Lake Reserve, Indian and Northern Affairs Canada, Occupational Health and Safety, and local residents.
  - Canadian Natural prepared to establish an evacuation/reception centre, if required, at the Hythe Motor Inn.
  - The GEOC was reactivated and informed that the next phase of well control operations was commencing.
  - The ERCB issued its second press release, informing the public of the well control operation.
  - The ERCB, AENV, and Canadian Natural brought all of their mobile AMUs into the area to monitor for emissions during the well control operations.
  - The RCMP set up and manned roadblocks about 4 km from the 9-12 site to ensure that no members of the public could enter the area.
- The well control specialists extinguished the flame at 2:30 p.m. and successfully installed the BOP. All gas from the well was directed through the BOP to the flare stack, and the flame was reignited at 3:45 p.m. The AMUs did not record any off-lease H_2S or sulphur dioxide readings, and no reports of odours were received during the operation.

From March 9 to March 31

- Canadian Natural tested the gas flow rate and H_2S concentration of the well between March 9 and March 11 to determine the optimum well control program. H_2S readings taken at the test separator during this period ranged from 700 to 1300 ppm. Canadian Natural also tested for hydraulic communication between the annulus and the drill pipe. The test indicated that there was no hydraulic communication and that the annulus was bridged somewhere downhole. Therefore, the drill pipe and the annulus would have to be addressed individually.
- On the evening of March 11, flow from the annulus was controlled, and in the early morning hours of March 12, flow through the drill pipe was also controlled. H_2S readings taken at the test separator during the procedures were 700 ppm. AENV released its MAML, and the ERCB released one of its AMUs on March 11. The ERCB and Canadian Natural developed plans for an appropriate air monitoring program during the final few

days of the incident. In the afternoon of March 12, the ERCB, in consultation with Canadian Natural, downgraded the response to the incident to a level-1 emergency.[1] At this time, both Canadian Natural and the ERCB began releasing surplus equipment and personnel. ERCB staff remained in direct contact with Canadian Natural for the duration of the well control and abandonment operations.

- On March 12, the ERCB released its third and final press release, informing the public that gas flow had been halted and that the well was under control.
- After several days of continued monitoring, the ERCB declared the incident over on March 18 and notified all involved parties. Canadian Natural completed the abandonment of the well on March 31 in accordance with ERCB requirements.

ERCB staff maintained a 24-hour-a-day presence at the OSCP from February 24 to March 13, and a daily presence from March 14 to 18.

The GPFC, ERG and Field Incident Response Support Team coordinated the ERCB response during the incident. The GPFC coordinated daily briefings for staff dispatched to the incident site and maintained a schedule to ensure adequate coverage throughout the incident. The ERCB's Consequence Management Officer attended the GEOC to coordinate information among Government of Alberta agencies.

All contaminated material from the site will be removed and sent to an appropriate disposal facility. The site will be reclaimed in accordance with AENV standards. Off-site samples were collected and analyzed by Canadian Natural to assess any contaminant migration, with none noted.

The release occurred in a sparsely populated rural area and received significant media attention. Canadian Natural issued one press release; the ERCB issued three. There were no evacuations required, no impact on public safety, and no injuries resulted from the incident.

1.1 Well History

The ERCB issued the license for the 9-12 well on December 10, 2009, as a New Pool Wildcat (NPW) well, as defined in ERCB *Directive 056: Energy Development Applications and Schedules* (June 2008).

Prior to licensing the well, Canadian Natural

- prepared offset maps to support designing the well and to plan drilling operations,
- researched offset wells to gain a better understanding of drilling times and downhole hazards that could be encountered, and
- conducted searches to determine offset pressures, H_2S concentrations, and absolute open flow potentials in the area.

[1] A level-1 emergency is defined as an incident where there is no danger outside the licensee's property, there is no threat to the public, and there is minimal environmental impact. The situation can be handled entirely by licensee personnel. There will be immediate control of the hazard. There is little or no media interest.

Canadian Natural commenced drilling the 9-12 well on January 20. An inspection by GPFC on January 27 found the drilling operations to be compliant with ERCB requirements.

Under Section 13.1 of *Directive 036: Drilling Blowout Prevention Requirements and Procedures*, the ERCB required during drilling, Canadian Natural was required to test surface and intermediate casing that was exposed to wear by pipe movement or a combination of rotation/movement every 30 days. The test of the 9-12 well was required to be completed no later than February 23. Section 13.2.1 of *Directive 036* permits operators to choose the testing method used. Specifically, operators may perform this testing either by pressure testing the casing or by running a casing integrity inspection log. On February 17, Canadian Natural contacted the GPFC to request a five-day extension of the testing. On February 17, the GPFC approved the request and required Canadian Natural to conduct the testing no later than February 28.

Because the applicable equipment was destroyed during the incident, it was not possible for the ERCB to examine the drilling equipment to determine whether this testing, if conducted by Canadian Natural, would have identified any problems regarding the casing bowl blind flange. However, analysis of the operations at the 9-12 well between 2:12 a.m. (when the rig crew noticed the kick) and 3:31 a.m. (when the presence of gas was detected) on February 24, indicate conditions in the well were similar to conditions that the well would have been subject to if pressure testing had been undertaken. There were no indications (e.g., visible leaks) during this period that the casing bowl flange was failing. This analysis suggests that the pressure testing, if conducted on February 23, may not have detected any problem with the casing bowl flange.

According to the tour reports for the 9-12 well, Canadian Natural recorded two kicks during drilling (February 16 and February 24). The drilling crew controlled the first kick, but was not able to control the second kick, which ultimately lead to the blowout.

2 ERCB Significant Findings

The ERCB conducted a review of all relevant materials, including information recorded by ERCB staff during and following the incident, Canadian Natural's evaluation of the incident, and the third-party analysis and technical explanation of the nature and circumstances of the blowout.

Canadian Natural retained Acuren Group Inc. (Acuren)[3] to perform an analysis of a sample of the surface casing and the BOP equipment. Acuren prepared three reports regarding its analysis of the components. The reports conclude that there was extensive erosion of the casing bowl blind flange caused by an extended period of leakage of high pressure fluids. Acuren was unable to determine what caused the initial leak in the casing bowl blind flange.

The ERCB has concluded that the blowout and resulting fire were caused by drilling into an abnormally high pressure formation and the subsequent failure of the casing bowl blind flange. The ERCB accepts the findings of Acuren.

[3] According to its Web site, Acuren is a "nondestructive testing, inspection and materials engineering firm focused on supporting mechanical integrity and inspection programs for clients in the Petrochemical, Refinery, Pipeline, Pulp & Paper, Power Generation, Pharmaceutical, Aerospace, and Automotive industries."

The ERCB considered the following regulatory documents in its investigation:

- *Oil and Gas Conservation Act* and *Oil and Gas Conservation Regulations* (*OGCR*)
- *Directive 036: Drilling Blowout Prevention Requirements and Procedures*
- *Directive 071: Emergency Preparedness and Response Requirements for the Petroleum Industry*

The ERCB has determined that there was a contravention of its regulatory requirements under the *OGCR*. Specifically, Canadian Natural's STICK[6] diagram for the 9-12 well did not contain all the required information, as set out in *Directive 036*. This contravention is discussed in more detail in Section 4: ERCB-Directed Actions.

Operations

With respect to Canadian Natural's drilling operations, the ERCB has identified, in addition to the above-noted contravention of its regulatory requirements, the following areas for improvement:

- There were a number of indications of potential pressure-related issues that Canadian Natural should have recognized prior to penetrating the target formation. For example,
  - mud densities from offset wells identified higher pressures than water gradient pressures (as indicated in Canadian Natural's *Sinclair 9-12 Incident Report*, Appendix 11),[7]
  - the four reports for drilling operations at the 9-12 well prior to penetrating the target formation identified several overpressure events, as well as the kick experienced at the 9-12 well on February 16 at 12:30 a.m., and
  - there were high background gas levels while drilling through several uphole formations.

  Taken both individually and cumulatively, this information should have indicated to Canadian Natural that it may encounter potential overpressure conditions during drilling, which, in turn, should have prompted additional precautions. Also, using oil-based (vs. water-based) drilling fluids, as done by Canadian Natural, hinders early identification of a kick situation. When drilling with oil-based drilling fluids, gas kicks are recognized using similar methods and indicators as with water-based drilling fluids, but the response is generally dampened. This is due to the fact that gases are more soluble in oil and oil-based drilling fluids, making kick detection more difficult since the gases stay in solution and are not released until they are near surface. Because of these factors, more training and diligence is required when drilling with oil-based drilling fluids.
- Exploratory wells require increased diligence when anticipated pressure gradients are not well known (as in this case) and appropriate precautionary measures must be taken in the preparation of well design and drilling plans. For example, Canadian Natural could have

[6] A STICK diagram is a well data information sheet specific to the drilling operations for a well which contains data obtained from research of offset well records.

[7] The recorded pressures encountered during drilling of the relief well by Canadian Natural confirmed the presence of higher pressures in the target formation.

installed intermediate casing and used a 35 megapascal (MPa) BOP stack prior to entering the last formation above the target zone (34 MPa on the STICK diagram).

Air Monitoring

On notification of the blowout, Canadian Natural dispatched two mobile AMUs, which commenced monitoring at 10:00 a.m. on February 24. The ERCB also dispatched two AMUs on February 24 to assist in monitoring activities. Canadian Natural contracted three additional AMUs in the early stages of the incident to provide monitoring. AENV dispatched the MAML to provide additional capabilities during the incident.

Canadian Natural assumed full control of the well on March 12 and monitoring concluded on March 17. A total of eight AMUs were operational during the incident. Seven of these AMUs were in place 24 hours a day from February 25 to March 13. The MAML was called away for several days during the blowout.

Airshed data collected at permanent monitoring stations established by the Peace Air Zone Association were reviewed and compared to data from the mobile units.

There were no recorded exceedances of the Alberta ambient air quality guidelines during this time. The ERCB has determined that the response of the monitoring units was timely and that the air monitoring plan in place ensured effective coverage of the area so that no member of the public was put at risk.

Emergency Response

As there were no surface developments in the EPZ for the well, the ERCB did not require a site-specific ERP. Canadian Natural drilled the well in accordance with its corporate ERP. The ERCB reviewed a copy of Canadian Natural's corporate ERP and determined, subject to the comments below, that it met applicable *Directive 071* requirements.

As previously mentioned, Canadian Natural established an OSCP adjacent to the 9-12 site and an OSCC and COCC at its head office in Calgary. Canadian Natural also established a REOC at its Grande Prairie office in the afternoon of February 24. Daily briefing meetings were held there until March 7.

While the ERCB has determined that Canadian Natural's corporate ERP met applicable regulatory requirements, it notes the following areas for improvement:

- Establishment of the OSCC and COCC in Calgary created an information flow that circumvented the REOC. Critical and timely information regarding the well control measures and logistics that were essential to the ERCB and other governing bodies was in some instances communicated directly between the blowout location and Canadian Natural's Calgary office.

- Canadian Natural's corporate ERP identifies the need for the OSCC to be located at the nearest Canadian Natural field office and for it to be attended by the off-site coordinator. In this incident, both the OSCC and off-site coordinator were located in Calgary. Locating the OSCC in Grande Prairie, as stated in the ERP, may have eliminated some of the communication issues.

- The site needed a command centre equipped with sufficient communication capabilities, size, and proximity to accommodate the various regulatory and governing bodies involved in the incident. The REOC, initially located at the GPFC, was set up to meet this need. The REOC was later moved to Canadian Natural's Grande Prairie office. Canadian Natural appeared to misunderstand the purpose of the REOC and the company's role in establishing, maintaining, and operating it.

- Canadian Natural representatives in the REOC were not able to answer questions regarding incident status, control measures, or logistics, nor were they able to make decisions on behalf of Canadian Natural. Canadian Natural did correct the situation by enabling the off-site coordinator to teleconference with the REOC.

Directive 071 states that "the ERCB strongly supports and encourages the use of the incident command system (ICS) as a means of ensuring consistent command and communication among all parties." Establishment and use of an ICS by Canadian Natural during this incident may have eliminated some of the issues identified above.

Public Interaction

While the ERCB has determined that Canadian Natural complied with applicable ERCB requirements regarding communication with the public, it notes the following areas for improvement.

- The ERCB received a request for information by members of the public on February 24 and asked Canadian Natural to respond to the inquiry. Canadian Natural was reluctant to engage the members of the public and provide the information being requested and instead deferred the request to the ERCB. The ERCB expressed concern with Canadian Natural's unwillingness to deal with the inquiry regarding the incident. On February 28, Canadian Natural established an e-mail system to handle inquiries. Licensees are responsible to properly and adequately communicate with the public following an incident at their operations.

- While the ERCB does not prescribe requirements of media communication, the ERCB notes that Canadian Natural issued one press release at the onset of the incident on February 24. It did not release media updates at significant milestones in the status of the 9-12 well (e.g., extinguishing the flame, installing a BOP, final abandonment).

The ERCB responded to the incident using all the necessary resources, which, in addition to both mobile AMUs, included staff from the

- FSOB management team,
- Grande Prairie, Drayton Valley, High Level, and St. Albert Field Centres,
- Well Operations Group,
- ERG and Field Incident Response Support Team (Incident Response Coordinator, Incident Investigators, and Consequence Management Officer),
- Community and Aboriginal Relations Group, and
- Communications Group.

All required agencies were contacted during the incident. Contact was also made with other agencies and stakeholders, including the County of Grande Prairie, Horse Lake First Nations,

First Nations Emergency Management, Alberta Health Services in Grande Prairie, and the mayor and residents of Hythe.

Canadian Natural completed drilling of the relief well on April 26, 2010. The 9-12 well was brought under control prior to completion of the relief well.

3 Actions Taken to Prevent Reccurrence

3.1 By Canadian Natural

Operations

As indicated in Canadian Natural's Sinclair *9-12 Incident Report*:

> Canadian Natural has implemented the following protocol and procedures on all wells with potential to penetrate high rate (absolute open flow potential > 1000 e^3m^3/d), high pressure (pressure gradient >16.0 kpa/m) gas reservoirs and/or wells with no analogous reservoir information (as per ERCB Directive 56; New Pool Wildcat Lahee classification) within a search radius of 30 km (six times the minimum radius recommended by ERCB Directive 008):
>
> - Install a minimum Class V BOP system.
> - Set intermediate casing if the Formation Integrity Test at midpoint to targeted well depth is less than 18.0 kpa/m equivalent gradient.
> - Utilize well test equipment to safely flow a minimum of 1980 e^3m^3/d gas.
> - In the event an 'abnormal kick' is encountered and the casing string is set deeper than 550 m, leave the well shut in and exceed the MACP [maximum allowable casing pressure].[8] [Note: The ERCB does not endorse this practice as it is contrary to well control practices that are currently accepted by industry.]

Emergency Response

- Canadian Natural noted that communication among people and parties involved in the initial ERP response was challenging. Canadian Natural is in the process of modifying its corporate ERP to improve and clarify roles and responsibilities.
- Canadian Natural has committed to share any findings with industry to assist in the prevention of similar incidents, such as the Canadian Association of Oilwell Drilling Contractors and Canadian Association of Petroleum Producers.

On October 4, 2010, Canadian Natural successfully addressed the enforcement action described in Section 4.

[8] "A kick is considered 'abnormal' if the stand pipe pressure bleeds off slowly (in minutes versus seconds) and pressure build-up occurs quickly (in seconds versus minutes)."

3.2 By the ERCB

Directive 036 Exemptions, Waivers, and Extensions

Staff in all ERCB offices have been reminded that all requests for waivers/exemptions and extensions of the requirements in *Directive 036* (except spacing) must be in writing and addressed to the Well Operations Group in Calgary.

4 ERCB-Directed Actions

The STICK diagram posted at the Canadian Natural well site did not identify the primary target formation pressure. Also, as stated in Canadian Natural's *Sinclair 9-12 Incident Report* (page 2), the forecasted pressure gradient for the target formation, predicted to be in the range of water gradient, was omitted from the STICK diagram. Canadian Natural has advised that it omitted this information in an effort to keep all information pertaining to the exploratory target formation confidential.

As detailed in *Directive 036*, Section 11.1.4:

> A "STICK" diagram is a well data information sheet specific to the drilling operation of a well (obtained from researching offset well records). It must provide the appropriate onsite personnel (e.g., licensee, rig manager, driller) with sufficient well control information to drill the well and must be posted in the doghouse.
>
> The STICK diagram must include, as a minimum, the following information:
>
> - geological tops,
> - anticipated formation pressures and mud weights required to control them,
> - potential problem zones (e.g., lost circulation, water flows, gas flows),
> - abnormal pressured zones (e.g., reservoir pressure maintenance),
> - potential H_2S zones, and
> - other well occurrence information.

During the course of its investigation, the ERCB noted that during a previous drilling rig inspection on January 27, 2010, ERCB staff failed to identify this noncompliance. Following discovery of this information, the matter was forwarded to the GPFC for follow-up and a High Risk Enforcement Action 1 was issued on September 9, 2010, for the following item:

> Section 8.142(1)(g) of the *OGCR* states that the licensee of a well shall at all times ensure that the procedures, calculations, formulas, and current data needed to control a kick at a well are posted at the rig in a form acceptable to the ERCB.
>
> Pursuant to *Directive* 036, appendix 1, Operational Deficiencies – section 11.1.4.2, STICK diagram does not contain all the required information.

The ERCB has reviewed all the information available on both the 9-12 well and the relief well and determined that the omission of information from the STICK diagram did not likely have any impact on, cause, or significantly contribute to the incident. In other words, the ERCB has concluded that inclusion of the information that was omitted from the STICK diagram by Canadian Natural would not likely have altered the course of events leading to, and resulting in, the blowout.

In addition to the actions taken to inform other parties of the circumstances of this incident, the ERCB directs that Canadian Natural submit a safety alert to Enform within 60 days of the issuance of this report. This will ensure that knowledge relating to this incident is shared with industry, so that operators can take action to determine if any similar problems exist at their well locations.

5 ERCB Follow-up

- The FSOB Drilling and Servicing Technical Specialist will review the procedures and operating policies for drilling rig inspections as outlined in *Directive 36* with all field surveillance drilling rig inspection staff. To be completed within 60 days of the issuance of this report.

- An FSOB committee will be struck to review the criteria and process applicable to processing and approving requests for exemptions from the requirements of *Directive 036* (including documentation requirements). In the interim, as indicated in section 3.2, staff in all ERCB field offices have been advised that all requests for exemptions under Directive 036 (except spacing) must be in writing and addressed to the Well Operations Group in Calgary. The committee's recommendations will be presented to the ERCB Board for consideration. To be completed within 180 days of the issuance of this report.

- The FSOB Well Operations Group will follow up with Canadian Natural on the submission of the Enform Safety Alert and its commitment to share its knowledge relating to the incident with other operators.

- The ERCB Emergency Planning and Assessment Section will follow up with Canadian Natural on its commitment to implement improvements to its corporate ERP identified in Section 3.1.

Figure 1. Area map

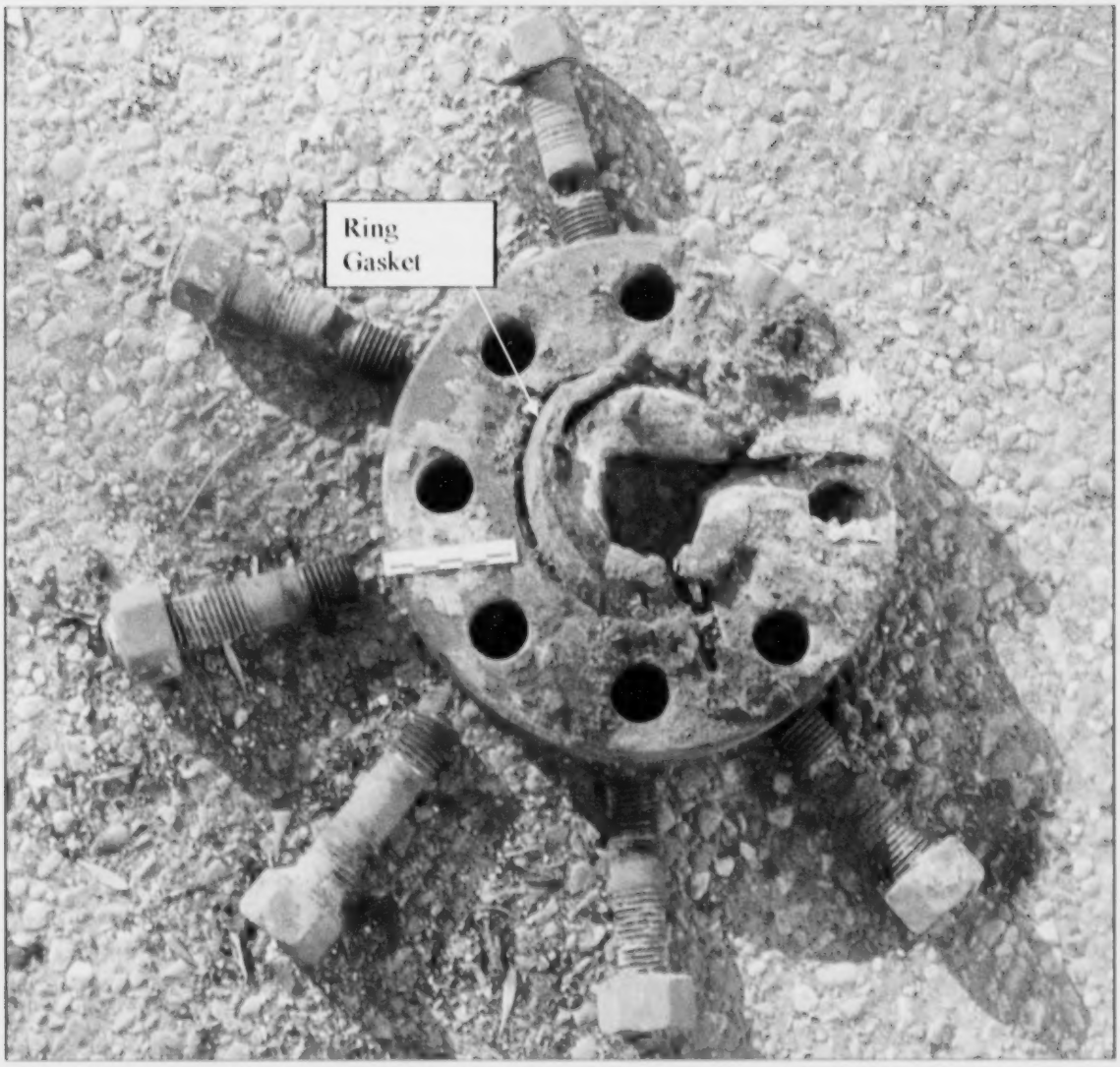

Figure 2. Exposed blind flange

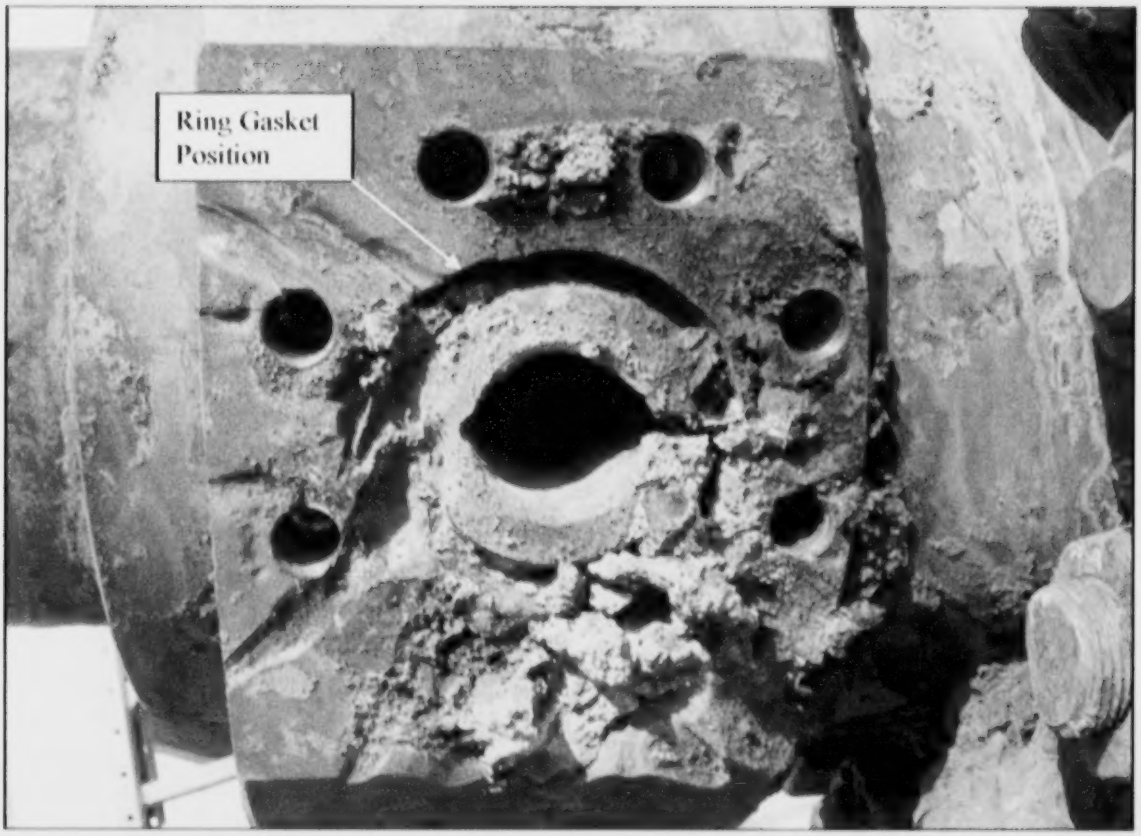

Figure 3. Casing bowl sealing faces